

**Gravitational-Viscoelastic Adjustment to Ice Sheet Change and Brittle Crustal Failure: A Link to the  $M_w$  8.1 March 25, 1998 Antarctic Plate Earthquake?**

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The effect of glacial isostatic adjustment (GIA) on the faulting potential of the Antarctic lithosphere is examined using a model that assumes an incompressible rheology, thus permitting a simple semi-analytical treatment. Our metric is the quantity,  $\Delta F$ , the Coulomb failure stress change [King *et al.*, *BSSA*, Vol. 84, 1994; Wu *et al.*, *GJI*, Vol. 139, 1999]. the same parameter as is used in earthquake stress transfer theory. One feature of GIA in Antarctica is that substantial ice load change continued through mid-Holocene times and possibly at a reduced rate up to the present. This is in contrast to most of North America and Fennoscandia, where ice mass change ceased in early Holocene times. A revision of the D91 Antarctic ice history of James and Ivins [*JGR* Vol. 103, 1998] is used as input to calculations of stress change in the Antarctic lithosphere. The revised load includes recently developed constraints on grounding line retreat in the Ross Sea, coastal Antarctic Peninsula, and Weddell Sea regions, and new constraints on interior ice heights at Last Glacial Maximum (LGM). During the culmination of LGM, seismicity is suppressed relative to the 'no-load' reference state although the suppression is limited in its spatial extent. The relatively youthful deglaciation in some parts of Antarctica produces large present-day values of  $|\Delta F|$  of 0.5 to 5 MPa at depths of 9 - 19 km within the Antarctic crust. These  $\Delta F$  values are a factor of 20 or more larger than those computed recently for the postseismic stress shadowing effects in the Californian and Anatolian interplate shear zones. This suggests that ice-sheet change in Antarctica potentially modulates seismic activity and is capable of driving the crust closer to failure even several hundred km offshore. However, such large horizontal scale stress shadowing is possible only when a long-wavelength bulge migration is supported by the existence of a thick ( $\approx$  150 - 250 km) cratonic lithosphere. The orientation and relative magnitudes of the background tectonic stress are also crucial parameters for successfully predicting a Coulomb stress field consistent with the great  $M_w$  8.1 March 25, 1998 Antarctic Plate Earthquake. We discuss the implications of postglacial seismicity studies in light of future geodetic observations which might constrain ongoing GIA phenomena in Antarctica.